



## Head injuries in men's and women's lacrosse: a 10 year analysis of the NEISS database

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**Introduction:** Although protective headgear is required in men's lacrosse, women's lacrosse is viewed as non-contact, and use of helmets and faceguards is prohibited. Yet, women remain at risk for injury to the head and face region from contact with the ball and stick. This study was designed to examine differences in lacrosse-related injuries between genders and amongst various age groups.

**Methods:** Data on lacrosse-related injuries maintained through the Consumer Product Safety Commission's National Electronic Injury Surveillance System, In-depth Investigation File, and Injuries/Potential Injuries File were analysed over a 10-year period (January 1990–April 2000).

**Results:** A total of 1727 cases of lacrosse-related trauma, mean age 16.9 years, range 4–59 years, were recorded. Males accounted for 80.5% of cases. The head and face region was the most common area injured (20.4%). Injuries to the head and face were significantly more prevalent among females (30.1% of all injuries) than males (18.0% of all injuries),  $p < 0.001$ , and often resulted from contact with the ball (33.6% of incidents). Children aged 4–11 years experienced the highest percentage of injuries to the head and face. Closed head injuries represented 5.6% of all lacrosse-related injuries and were slightly more prevalent among females.

**Conclusions:** Women and children lacrosse players are at risk of serious injury to the head and face region. The use of protective head/face gear should be encouraged.

### Introduction

Lacrosse continues to rapidly grow in popularity at all levels of competition within the US [1, 2]. The game, which originated among Native Americans and was known in some areas of North America as 'baggataway', was adopted by European settlers in the mid-19th century. Renamed lacrosse because of the stick's resemblance to a bishop's crozier (*la crosse*), today's sport has evolved into two distinct games, a men's and a women's version, both representative of two of the fastest growing collegiate and interscholastic sports. Men's lacrosse is a high-contact sport. Body and stick checks are permitted and players wear full protective gear including helmet with face guard, mouth guard, shoulder pads, arm pads and gloves. Additional rib padding is optional [3]. Women's lacrosse is non-contact. Protective gear, other than mouth guards (required) and protective eyewear and soft headgear (recently approved for optional use), are not permitted except at the goalie position

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where helmet, face guard, and other protective gear are worn [4]. The sport relies on rules and style of play to minimize injury risk [5].

Data from the National Collegiate Athletic Association's (NCAA) injury surveillance system has demonstrated higher rates of injury to the head and face in collegiate women lacrosse players when compared to men. In the 1998/1999 season, head injuries represented 15% of all game-related injuries in women, exceeded only by ankle injuries, which had a prevalence of 21%. During the 1999/2000 season, head injuries ranked third in site of injury, exceeded only by injuries to the knee and upper leg [6, 7]. A study of interscholastic women's lacrosse found injuries to the head and face more common than any other body area including the ankle, knee, and upper extremity [5]. Fifty-six per cent of these injuries were stick-related and 35% resulted from contact with the ball. Several published case series have reported on head and face injuries among women lacrosse players and argued for the addition of protective eye gear and helmets during play [8–10]. A study by Webster *et al.* [11] found a marked reduction in facial injuries, particularly to the periorbital and forehead regions, with the use of protective eye-wear in scholastic women's lacrosse.

However, others have argued that the strict non-contact rules governing the sport of women's lacrosse make the use of helmets and other protective wear unnecessary [12]. Some believe that the addition of protective gear would drastically alter the game as it is currently played, lead to more reckless play, and ultimately increase the risk of injury. Goldenberg and Hossler [5] noted that, despite the high prevalence of injuries to the head and face observed in their study, the lack of severity of these injuries led them to conclude that helmet use was not indicated.

The following study was designed to further examine and contrast the demographics and epidemiology of head and face injuries occurring during lacrosse play among different age groups and between genders.

## Methods

Data were obtained for a 10-year period (January 1990–April 2000) on lacrosse-related injuries from three electronic databases maintained by the US Consumer Product Safety Commission's (CPSC) National Injury Information Clearinghouse [13]. The National Electronic Injury Surveillance System (NEISS), which was established in 1972, was designed to provide a statistically representative sampling of emergency departments nationwide. Currently, NEISS collects data on product and recreational-related injuries from 100 hospital emergency departments throughout the US. The In-Depth Investigation File contains reports maintained by the CPSC on investigations into product-related injuries. Finally, the Injury/Potential Injury Incident File contains data on product-related injuries obtained from various sources including Hotline reports and letters filed with the CPSC, newspaper accounts, and medical examiners' reports.

Data analysed included subject age, gender, body part injured, type of injury, disposition following release from the emergency department, and cause of injury. In ~30% of cases involving injury to the head or face region, a specific cause such as contact with the lacrosse stick or ball could not be determined from the data provided. Statistical analyses were performed using SPSS 10.0. Although most data reported was descriptive, Pearson chi-square test or Fisher's Exact test were used for comparison of non-continuous variables. All tests were two-tailed.

## Results

A total of 1727 cases of lacrosse-related trauma were recorded with a mean age of 16.9 years (SD = 4.3). Age ranged from 4–59 years, with most subjects (64%) falling between the ages of 12–17 years. Males accounted for 80.5% of cases. The most common area injured among all age groups was the head and face region, representing 20.4% of recorded injuries (see table 1).

Twenty-four per cent of these injuries were classified as closed head injuries or concussions (see table 2).

Trauma to the nose, eyes, and mouth constituted respectively 18.5%, 10.2%, and 9.9% of injuries to this region (see table 3).

Head/face injuries were followed by injuries to the finger (12.8%), shoulder (11.5%), and ankle (11.1%) in relative prevalence. Ninety-eight per cent of patients were treated/evaluated and released. Of the 26 patients with specified diagnoses who were either hospitalized or transferred to another facility for further care, nine of these cases represented injuries to the head or face region (see table 4). Three deaths were recorded, all of which were secondary to trauma to the chest region.

Injuries to the head and face region were significantly more prevalent among females (30.1% of all injuries) than males (18.0% of all injuries),  $p < 0.001$  (see table 1). Women were more likely to sustain injuries to the head and face from contact

Table 1. Body regions injured during lacrosse play by gender

Region injured	Percentage of all injuries	
	Male	Female
Head/face	18.0	30.1
Shoulder	13.6	3.0
Ankle	8.9	20.2
Finger	12.7	13.4
Knee	8.4	8.6
Upper trunk	7.3	0.9
Wrist	6.0	3.3
Hand	4.0	5.7
Elbow	4.2	1.5
Lower arm	3.7	2.4
Lower leg	2.7	1.8
Neck	2.8	0.6
Foot	1.7	3.3
Other	6.0	5.2

Table 2. Injuries to the head and face region by type of injury

Type of injury	Number	Percentage
Laceration	131	37.2
Contusion/abrasion	84	23.9
Closed head injury/concussion	84	23.9
Fracture*	31	8.8

\*Includes 26 nasal fractures, three orbital fractures, one skull fracture, and one mandibular fracture.

Table 3. Injuries to the head and face region by body part

Body part	Number*	Percentage
Head	111	31.50
Face	83	23.60
Nose	65	18.50
Eye	36	10.20
Mouth	35	9.90
Chin	20	5.70
Ear	2	0.60

\*Total  $n = 352$ .

Table 4. Cases hospitalized or transferred to another facility for further care

Diagnosis	Age	Gender
Head/face injuries		
Concussion	18	Male
Concussion	16	Male
Concussion	12	Male
Concussion	7	Male
Skull fracture	15	Male
Face laceration	17	Male
Face laceration	17	Female
Fractured nose	16	Male
Blunt eye trauma	16	Male
Chest/shoulder injuries		
Chest injury	19	Male
Chest injury	15	Male
Fractured shoulder	18	Male
Shoulder injury	16	Male
Extremity injuries		
Thumb contusion	19	Male
Fractured wrist	17	Male
Finger sprain	13	Male
Dislocated knee	19	Male
Knee injury—MCL tear	17	Male
Fractured femur	16	Male
Ankle sprain	13	Male
Internal injuries		
Kidney injury	19	Male
Kidney injury	15	Male
Laryngeal trauma	15	Male
Liver laceration	16	Male
Liver contusion	15	Male
Spleen injury	15	Male

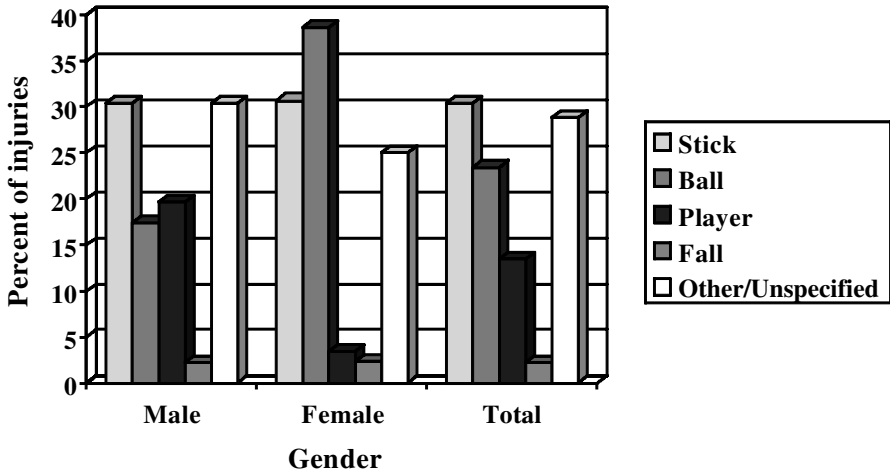


Figure 1. Cause of head/face injury by gender.

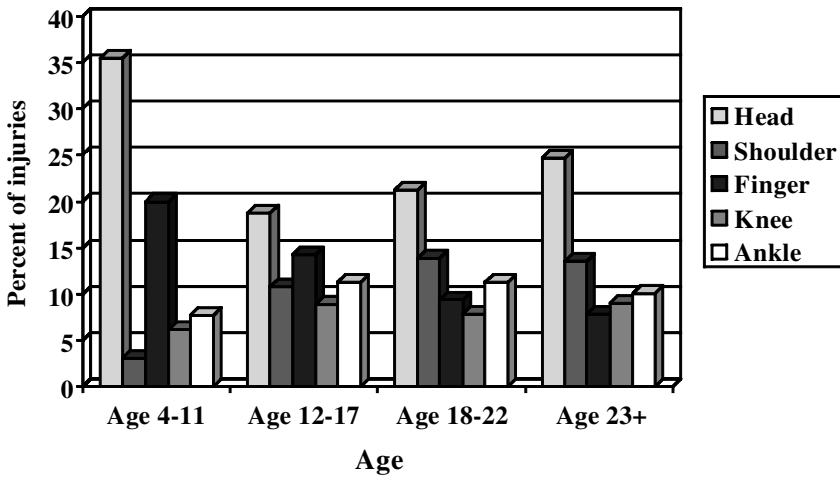


Figure 2. Most common body regions injured during lacrosse play by age group.

with the ball (38.6% versus 17.4%;  $p < 0.005$ ), while males were more commonly injured by another player (19.6% versus 3.4%;  $p < 0.001$ ) (see figure 1).

The youngest players, aged 4–11 years, were at greater risk of injury to the head and face region when compared with players aged 12–17 years (35.4% of injuries versus 18.8%,  $p < 0.05$ ), and a similar trend was found compared to players aged 18–22 years (35.4% versus 21.2%,  $p = 0.056$ ) (see figure 2). Although cause of injury varied between age groups (see figure 3), no differences reached statistical significance.

In order to specifically examine closed head injuries, data was then re-analysed to include only those cases classified as concussion or internal organ injury to the head region. Closed head injuries represented 5.61% of all lacrosse-related injuries. Prevalence was slightly greater among females (6.54%) than males (5.39%). Player–player contact was the most commonly specified cause of closed head injury among

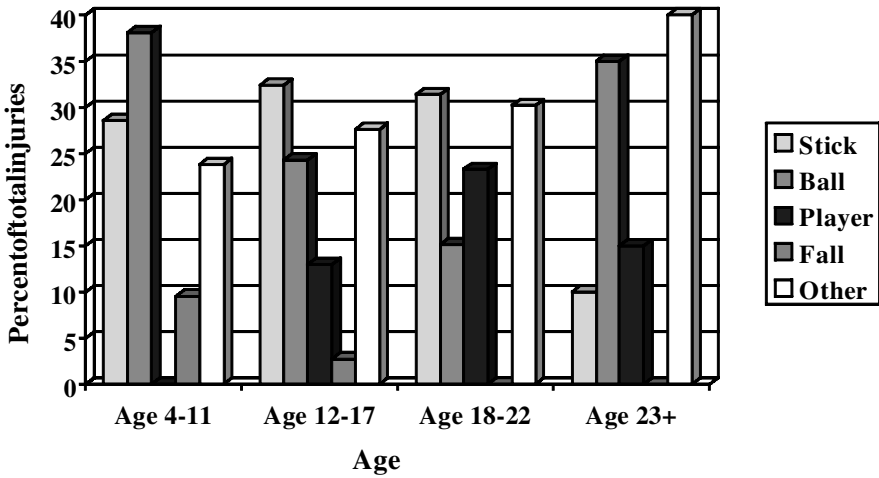


Figure 3. Cause of head/face injury by age group.

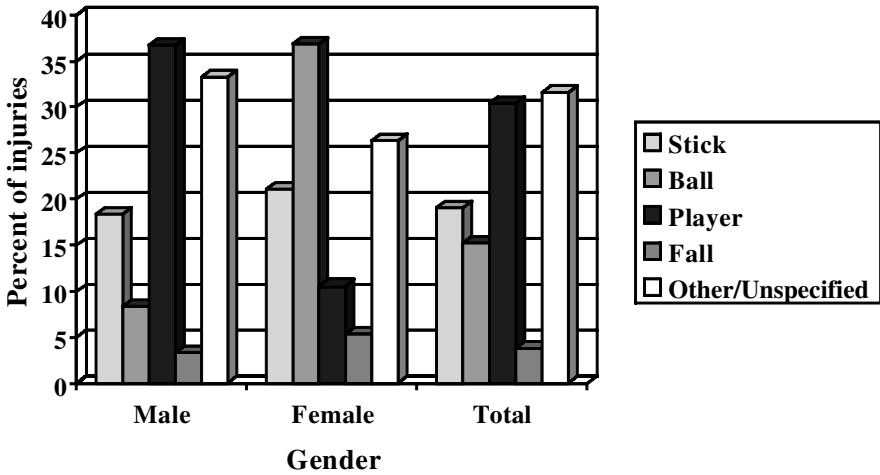


Figure 4. Cause of closed head injury/concussion by gender

subjects (30.4%) (see figure 4), whereas it contributed to only 13.4% of all types of injuries to the head and face region ( $p < 0.005$ ) (see figure 1). Again, females were more likely to be injured by the ball (36.8% versus 8.3%,  $p < 0.05$ ) when compared with males. Males appeared more likely to sustain a closed head injury through player/player contact when compared with females (36.7% versus 10.5%); however, this difference did not reach statistical significance ( $p = 0.146$ ).

## Discussion

The NEISS and other databases maintained by the CPSC provide an excellent tool for examining and contrasting lacrosse-related injuries between genders and among different age groups. These findings indicate that, despite differences in the rules governing play between men's and women's lacrosse, women are at risk of serious trauma to the head and face region. The 'non-contact' nature of the women's game

does appear to influence the predominant mechanism of head trauma, shifting it from player contact to impact with either the ball or stick.

Considerable debate continues regarding the use of protective headgear in women's lacrosse [8, 9, 11, 12, 14]. Protective eyewear was recently approved for optional use. Additionally, agreement was reached between the US Women's Lacrosse Association and the NCAA to permit the optional use of soft headgear [14]. However, use of helmets remains prohibited in women's lacrosse but a requirement in men's lacrosse. The findings of this study suggest that the use of additional protective headgear should be encouraged in women's lacrosse. Despite restrictions on body and stick checks, the mechanics of the game, which include the use of a hard ball and stick, a target box for catching passes at the level of the player's head adjacent to the ear, rapid rates of ball travel (up to 90 miles per hour in the men's game) [15], and close player/player positioning during competition, place all players at risk of head injury.

Injuries in children also frequently involved the head and face region. In fact, the youngest children, aged 4–11 years, appeared particularly at risk of injury to this area. As in women's lacrosse, the mechanism of injury was primarily contact with the ball. Use of protective gear at the scholastic level is limited [11]. Additionally, player skill, such as stick control and ability to pass and safely catch the ball, may place younger players at increased risk of injury to the head and face, despite limited player/player contact [5].

The results of this study support the use of protective headgear in both women's and youth lacrosse, despite the rules limiting player–player contact.

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